

Health Consultation

Determination if Remedial Actions are Protective of Public Health

HERCULANEUM LEAD SMELTER SITE

HERCULANEUM, JEFFERSON COUNTY, MISSOURI

EPA FACILITY ID: MOD006266373

APRIL 16, 2002

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation

Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

Missouri Department of Health and Senior Services
Section for Environmental Public Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry

Statement of Issues and Background

Statement of Issues

In January of 2002, the Missouri Department of Health and Senior Services (DHSS) and the Agency for Toxic Substances and Disease Registry (ATSDR) were asked by the Missouri Department of Natural Resources (MDNR) and the U.S. Environmental Protection Agency (EPA), respectively, to determine if the ongoing and planned removal actions at the Herculaneum Missouri Lead Smelter Site were sufficient to protect public health, and to identify any sensitive sub-population that would require special consideration (1, 2). This document responds to both requests.

Background

The Herculaneum lead smelter is an active facility that has been in operation in this community since 1892. The Doe Run Company currently owns and operates the smelter. The facility is located at 881 Main Street in Herculaneum, Missouri, approximately 25 miles south of St. Louis, Missouri, on the Mississippi River. It abuts residential neighborhoods on the north, west, and south, with the Mississippi River on the east. A lead ore concentrate, consisting of approximately 80% lead sulfide, is processed at the smelter. The ore is transported by truck from eight lead mines operated by the company near Viburnum, Missouri, approximately 75 miles south-southwest of Herculaneum. The 52-acre Herculaneum facility consists of a smelter plant, 24-acre waste slag storage pile, and an onsite sulfuric acid plant (3).

The city of Herculaneum has an estimated population of 2,805 persons, according to the 2000 US Census. Several homes are within 200 feet of the smelter plant, and at least four homes are within 200 feet of the slag pile. Figures 1 and 2 display the location of the smelter in relationship to the community (4). Three schools are in the city: a high school, a junior high school, and a middle school. The elementary school is in nearby Pevely. There are no licensed day-care facilities in the city of Herculaneum.

Environmental sampling has shown lead contamination throughout the community. For example, lead has been found in yard soils at concentrations up to 33,100 parts per million (ppm) (5); in air ranging from non-detectable (ND) to 85 micrograms per dry standard cubic meter ($\mu\text{g}/\text{dsm}^3$) (6); in dust on streets ranging from 30,000 ppm to 300,000 ppm (7), in interior dust (i.e., from living spaces of homes) as high as 3,600 micrograms per square foot ($\mu\text{g}/\text{ft}^2$), and in unoccupied spaces in homes (e.g., attics) as high as 40,000 $\mu\text{g}/\text{ft}^2$ (sampling in these areas is very limited) (8). Past monitoring of air emissions indicates that the facility, specifically the number five, down-wind air monitor (bluff location), has never been in compliance with the National Ambient Air Quality Standard for lead emissions of 1.5 $\mu\text{g}/\text{dsm}^3$ (quarterly average) (2).

Although multiple sources of lead could be contributing to the overall contamination (e.g., lead-based paint), a recent Exposure Investigation (EI) by ATSDR indicates that lead in paint and water at the two homes evaluated during the EI do not appear to be significant sources of lead exposure in the children with elevated blood lead concentrations (9). Additionally, available blood lead level data suggest that proximity to the smelter appears to be associated with higher blood lead levels (BLL). Twenty-eight percent (28%) of children in this community under 72 months of age who were blood lead tested in 2001 have blood lead levels equal to or above 10 micrograms per deciliter (10 µg/dL). In the area closest to the smelter, east of U.S. Hwy 61 (Commercial Blvd), 45% of the children under 72 months of age who were tested in 2001 have blood lead levels equal to or above 10 µg/dL (10). Blood lead levels above 10 µg/dL have been associated with the development of adverse health effects (11). Based on this information DHSS recently determined that the site conditions represent an urgent public health hazard (10).

Efforts to address soil and interior dust contamination were ongoing when, in September 2001, MDNR and EPA confirmed that spillage of lead concentrate was occurring along transportation routes in the city (7). This information prompted DHSS to alert MDNR that the risks to the public surrounding the site are clear and present, and are an imminent and substantial endangerment to the health of residents of Herculanum (12). Subsequently, MDNR and EPA directed the Doe Run Company to expedite activities to clean up existing contamination and reduce/eliminate future contamination throughout Herculanum. The facility is currently attempting to address this contamination under an Administrative Order on Consent as well as other agreements with MDNR and EPA (2,13,14,15,16,17,18). Activities planned include the following:

- Smelter air emissions and fugitive dust are being reduced by installation of a number of equipment up-grades and process modifications. These are to be completed by August 2002 in order to meet the National Ambient Air Quality Standard for lead (1.5 µg/dsm³, quarterly average);
- Soil removal in public and private yards, parks, schools, and along roadsides, where lead levels are greater than 400 ppm, based on a multi-aliquot sample (yards are divided into quadrants and nine randomly collected aliquots are combined into one composite sample from each quadrant; for any quadrant where the level of lead in the composite sample is greater than 400 ppm, the entire quadrant is replaced with clean soil; play areas, non-paved driveways and yard areas next to streets are also considered in addition to the quadrant sampling). Contaminated soil is being removed to a depth of one foot and replaced with soil containing the normal background level of lead (50-150 ppm). The yards are prioritized for clean-up based schedule outlined in the following table:

Category	Time Frame for Soil Replacement
Homes with children at or under 72 months old with blood lead level in excess of 10 µg/dL and soil lead level exceeding 400 ppm	Within 30 days of being notified by EPA of location of residence
Child care providers with soil lead levels exceeding 400 ppm lead	Within 30 days of being notified by EPA of location
Homes with resident children at or under 72 months old and soil lead level exceeding 400 ppm	Within 4 months of effective date of the EPA order
Homes, parks, playgrounds, and elementary schools with soil lead level exceeding 10,000 ppm	Within 6 months of effective date of the EPA order
Homes, parks, playgrounds, and schools with soil lead levels between 2,500 ppm lead and 10,000 ppm lead	Within 12 months of effective date of the EPA order
Homes without children under 72 months of age and with soil lead levels 400 ppm - 2,500 ppm lead	60 homes per year beginning January 1, 2003
Homes of other persons identified as being sensitive to lead exposure (e.g., pregnant women and children older than 72 months with elevated blood leads)	As necessary

- In-house dust is being removed according to a protocol developed by EPA. In summary, home interior cleaning of habitable spaces consists of

- vacuuming of carpets and upholstered furniture using vacuums equipped with high efficiency particulate air (HEPA) filters;
 - wet wiping hard surfaces (e.g., floors, tables, and counter tops) with a 5% solution of trisodium phosphate;
 - elimination of attic access and ventilation connections; and,
 - taking dust wipe samples for verification of cleaning (2).
- Residents are being offered temporary relocation from the time their homes are determined to be contaminated (even if the home is not immediately scheduled for cleaning) until the homes and yards are cleaned. The offer for temporary location includes pregnant women and children older than 72 months with elevated blood lead levels. Fewer than half of the residents offered relocation have accepted;
 - Residents have been offered HEPA filter vacuums to assist in controlling interior dust levels. These have been offered to residents whether or not their homes have been cleaned-up yet;
 - Lead ore concentrate shipping methods will be modified to reduce or eliminate spillage during transport through town, which will help reduce recontamination. While the company is developing a plan for addressing the issue long-term (EPA is reviewing a proposal currently), several actions to address the issue have already been implemented including: daily street sweeping/vacuuming, and exterior truck washing (to remove lead ore concentrate from the exterior of the truck); and,
 - To address concerns, based on initial calculations by MDNR that recontamination could occur after clean-up, MDNR and EPA are planning a study to determine the likelihood and rate of recontamination.

Recent street sampling at various locations along the truck haul routes in Herculaneum has shown that lead concentrations in street dust are variable. As recently as February 18, 2002, levels on streets were measured as high as 85,000 ppm. In particular, on February 18, 2002, in a residential neighborhood, sampling found 48,000 ppm. On December 18, 2001, sampling at this same location revealed a lead dust level of 470 ppm (19). Thus in two months, the levels at this particular location increased by over 100 fold.

In a March 21, 2002, meeting with MDNR, EPA, DHSS, the Missouri Attorney General's Office and the Missouri Governor's Office, the Doe Run Company agreed to offer a voluntary property acquisition of homes within a specified geographic area approximately 3/8 mile around the smelter. The offer would be extended immediately to homes in the specified area with children younger than 72 months of age residing in them. The rest of the buyouts would occur by the end of 2004. Details of this voluntary property acquisition arrangement have not yet been made public. Once these details are released, this Health Consultation will be updated, if necessary.

DISCUSSION

Pathways of exposure to lead at the Herculaneum site are ingestion and inhalation for the past and present, with the potential for similar exposure pathways in the future. Currently, people could become exposed to lead in the community through ingestion or inhalation of lead particles from contaminated soil and indoor dust, as well as inhalation of lead from ambient air contaminated by emissions from the smelter operation. In addition, people could potentially be exposed to lead dust through the movement of dust particles from inaccessible and little-used areas in the homes (e.g., attics, wall voids, and cellars) into the living spaces. These inaccessible areas are not being cleaned under the present remediation protocol.

The ongoing actions will reduce exposures in several ways. Specifically, lead exposure to contaminated soils will be reduced because contaminated soil is being replaced with clean soil. Current exposures to dust inside homes are being reduced because of the cleaning efforts, and the supplying of HEPA vacuums to residents will help keep interior dust levels controlled. Similarly, the daily street cleaning program coupled with the truck washing program is expected to reduce dust from spillage along haul routes while a more permanent solution is developed.

Nevertheless, several gaps in these activities must be considered.

- The residential cleaning plan includes dust wipe sampling to verify the effectiveness of the clean-up. While it is clear that clean-up efforts reduce the overall dust contamination in homes, DHSS/ATSDR cannot determine from this sampling if the clean-up is effective in reducing potential exposures. A sampling method that reveals the concentration of lead in household dust is necessary;
- The residential cleaning activities do not include cleaning of inaccessible areas such as attic spaces, wall voids and cellars. In limited sampling, attic dust samples have been found to contain levels of lead as high as 40,000 $\mu\text{g}/\text{ft}^2$. Since this sampling is limited, levels could be even higher in some homes. Over time, lead dust from these areas could recontaminate the living spaces;
- The plan calls for homes with soil levels between 400 ppm - 2,500 ppm with no children currently in residence to be cleaned at a rate of 60 per year beginning in 2003. If children were to move into homes in which no children currently reside, it would give them higher priority for clean-up. But, there doesn't appear to be any mechanism to alert EPA/MDNR if children move into these homes prior to their scheduled clean-up. This could lead to exposure for any children who might live in these homes in the future.
- No activities have taken place to address potential migration of lead-contaminated dust from the slag pile; and,

- Lead concentrations in street dust are variable.

The actions planned are expected to substantially reduce current exposures. As can be seen in the street dust concentrations, however, these activities might not always be effective. Also, it is not currently possible to accurately assess home cleaning effectiveness. Therefore, DHSS/ATSDR have insufficient information to fully assess the protectiveness of the actions currently being taken. In addition, because there will be ongoing emissions and because some indoor areas are not being cleaned, it is possible soils and living areas will be recontaminated over time. EPA and MDNR are initiating studies to determine the rate of recontamination. Until those efforts are complete, insufficient information exists to fully evaluate future exposure scenarios. Put another way, it cannot now be determined how long the actions being taken will remain protective.

Child Health Initiative and Susceptible sub-populations

Childhood lead poisoning is a major, but preventable, environmental health problem. Children are a high risk group. They are generally assumed to be at an increased risk of exposure to chemicals in soil due to their more frequent soil contact and tendency to ingest soil, either intentionally or through normal hand-to-mouth behavior. Exposure to lead *in utero*, in infancy, and in early childhood can slow mental development and lower intelligence later in life. Further, children have developing body systems that can sustain permanent damage if toxic exposures occur during critical growth stages. Compared to adults, children absorb more of the lead they take into their bodies, retain more of the lead they do take in, and are more sensitive to its effects (20). The Centers for Disease Control and Prevention (CDC) recommends that BLLs remain below 10 µg/dL to decrease the likelihood of neurological and learning problems in children.

Because of the potential effects on developing fetuses, pregnant women or women who are likely to become pregnant are another population of concern. Other unusually susceptible populations could include, depending on individual circumstances, the elderly, people with inheritable genetic diseases (e.g., thalassemia), and people with neurological dysfunction or kidney disease (11,20).

CONCLUSIONS

Although the effectiveness of some of the actions taken at the site cannot be fully assessed at this time, the current plan clearly includes provisions that are expected to reduce exposures and address the existing health threat for Herculaneum residents. Additional information is needed to assess the likelihood and rate of recontamination, and to determine how long the actions taken will remain protective. Specifically DHSS/ATSDR concludes the following:

1. Implementing the current and planned removal activities at this site and in the surrounding community (including the temporary relocation plan), should reduce exposures to the community.
2. DHSS/ATSDR are unable to determine if the indoor cleaning is effective, given the current verification sampling.
3. It appears that lead levels in street dust are variable.
4. DHSS/ATSDR are unable to determine how long the actions will remain protective of health because there is not enough information about potential recontamination.
5. While the actions proposed are protective, several issues are not fully addressed, including:
 - the potential for lead-contaminated dust in uninhabited spaces to recontaminate homes after cleaning or a plan to eliminate that possibility;
 - a plan for remediating homes where no children currently reside with soil lead levels of between 400 ppm - 2,500 ppm;
 - emissions from the slag pile; and,
 - the apparent recontamination of streets.

RECOMMENDATIONS

1. Expand and accelerate response/removal efforts to expeditiously resolve the public health concerns that exist in Herculaneum.
2. Develop and implement an alternative method for verifying the effectiveness of home cleaning efforts.
3. Continue with the ongoing effort to develop and implement the proposed evaluation of recontamination. If the evaluation results indicate recontamination will occur, develop a plan to regularly monitor and ensure that contamination levels in homes remain below levels of health concern. MDNR and EPA are initiating this action.
4. Develop and implement a plan to assess the potential for lead-contaminated dust from uninhabited spaces (which are not currently being cleaned) to recontaminate living spaces of homes, or take steps to eliminate/reduce the potential for future recontamination from those potential interior sources, or both.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Herculaneum Lead Smelter Site contains a description of actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substances and Disease Registry (ATSDR), and other involved parties. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and future exposures to contamination from the site. Included is a commitment from DHSS, ATSDR, or both to follow up on this plan to ensure that it is implemented.

1. EPA/MDNR are negotiating with Doe Run to implement the actions listed in this document according to the stated schedule.
2. EPA/MDNR have a plan in place to address sensitive sub-populations.
3. DHSS/ATSDR have developed and are implementing a comprehensive health education plan in this community. Those efforts will continue and will focus on increased childhood lead testing, awareness of lead poisoning and its adverse health effects, and how to reduce exposures, especially to children.
4. DHSS/ATSDR/Jefferson County Health Department will assure that community members are aware they can have blood lead testing done by requesting it from their medical provider or the Jefferson County Health Department.
5. DHSS/ATSDR/Jefferson County Health Department will monitor blood lead data from the community to assess exposure levels continually, especially during summer months (period of peak exposures).
6. Jefferson County Health Department/DHSS/ATSDR will continue to assure case management of children with elevated blood lead levels.
7. EPA and MDNR are designing recontamination evaluations so that potential recontamination of soil and indoor dust from the smelter operations are accurately assessed. In addition, they will assess whether recontamination is occurring from inaccessible areas of the home. These evaluations are currently in the planning stages.
8. DHSS/ATSDR will work with EPA and MDNR to identify proper verification sampling methods following indoor cleaning.
9. Once the details of the voluntary property acquisition agreement are made public, DHSS/ATSDR will update this Health Consultation, if necessary.

10. DHSS/ATSDR are evaluating the feasibility of initiating health studies in this community.

Report Prepared by: Gale Carlson, Arthur Busch, Scott Clardy, Missouri Department of Health and Senior Services

Attachments: Figure 1 - Site Map
Figure 2 - Site Map


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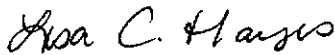
Certification

This health consultation for the Herculaneum Lead Smelter Site, Determination if Remedial Actions are Protective of Public Health, was prepared by the Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved methodology and procedures at the time the health consultation was initiated.



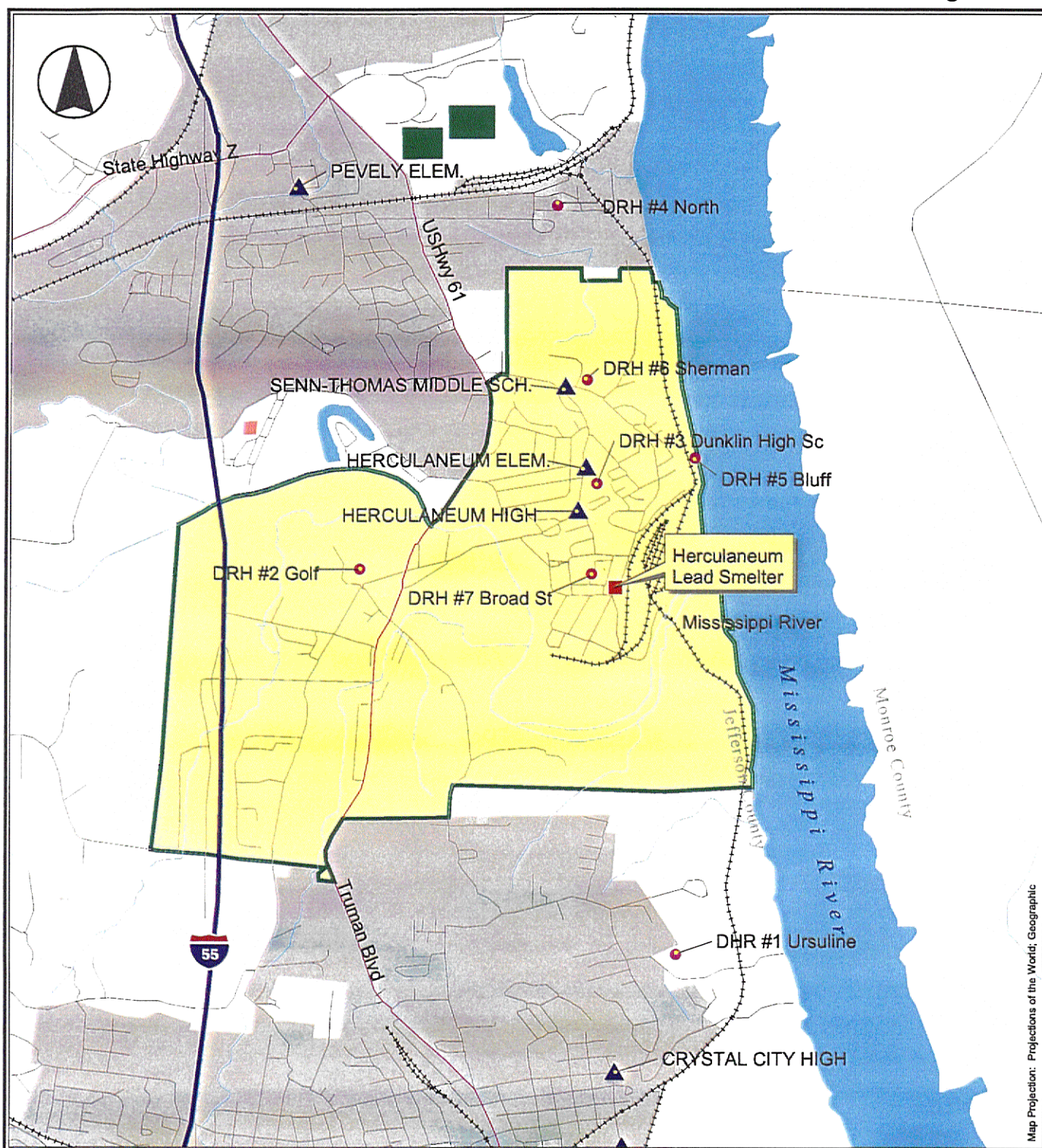
Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC). ATSDR. has reviewed this health consultation and concurs with its findings.



for Section Chief, SPS, DHAC, ATSDR

Figure 1



Map Projection: Projections of the World; Geographic

Herculaneum Lead Smelter

Herculaneum, MO

CERCLIS No. MOD006266373

VICINITY MAP

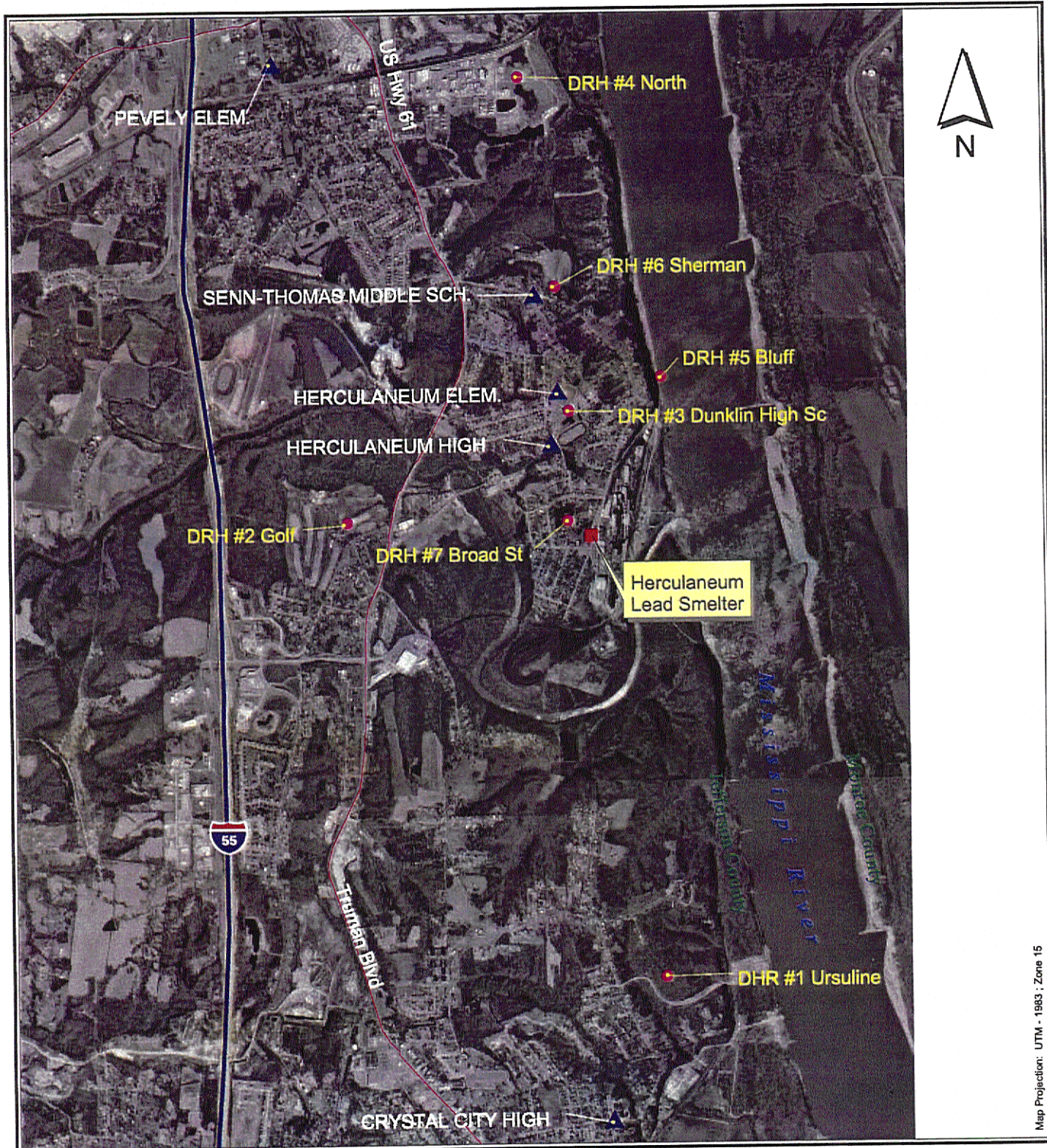


Jefferson County, MO

ATSDR SAAGIS

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Figure 2



Herculaneum Lead Smelter

Herculaneum, MO

CERCLIS No. MOD006266373

VICINITY MAP



Jefferson County, MO



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